Macroinvertebrate Production in Broadleaf Marshes

Expectation:	A statistically significant increase in floodplain broadleaf marsh macroinvertebrate production.
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Relevant Endpoint(s):	Restoration – Biological Integrity – Productivity Restoration – System Functional Integrity – Habitat Quality Restoration – System Functional Integrity – Energy Flow Dynamics

Baseline Condition:

Mean (Year 1 Production + Year 2 Production / 2) macroinvertebrate community production from broadleaf marsh habitats sampled between August 1995 and May 1997 was 6.4 and 6.0 g/m^2/yr in Pools A and C, respectively. Over 76% of total broadleaf marsh production in Pool A is attributable to water mites (Acarina). Only one other taxon, *Polypedilum* sp., accounted for greater than 5% of total production within this habitat. Over 36% of total production in Pool C is attributable to three taxa: *Fittkauimyia* sp. (18.1%), *Procambarus fallax* (10.5%), and *Laccophilus* sp. (7.4%). The remainder of production was divided among 63 taxa, of which, only 20 contributed greater than 1% of total broadleaf marsh production.

Reference Condition:

Historical data on annual production of broadleaf marsh macroinvertebrates from the Kissimmee River are not available. In fact, production estimates for floodplain macroinvertebrate communities and individual taxon are rare (Smock et al. 1985; Gladdon and Smock 1990; Smock et al. 1992; Duffy and LaBar 1994; Pickard and Benke 1996). The expectation for increased aquatic invertebrate production is based on expectations for restored aquatic invertebrate community structure including an increase in species richness, year-round persistence of a diverse aquatic invertebrate community, increases in mean annual biomass for most taxa, and the potential for high biomass turnover rates (annual P/B ratios) for many taxa. Because the magnitude of production depends on only two parameters, standing stock biomass and biomass turnover rates, factors affecting one, or both, will influence rates of production (Benke 1984). For instance, dipterans may account for > 30% of all taxa and > 50% of total individuals in natural flatwoods marshes of central Florida (Evans et al. 1999). Assuming a cohort P/B ratio of 5 (Waters 1969) and a mean developmental time of 21 days, annual P/B ratios for many dipterans can approach 90, which means biomass turnover time may be as short as 4 days. Annual P/B's in this range and greater have been reported for numerous Diptera from a variety of aquatic systems (Benke et al. 1984), and indicates the potential for high turnover rates for some taxa to contribute to high rates of annual production. Additionally, densities of large invertebrates (e.g., crayfish, grass shrimp, amphipods, and odonates) can be high in natural marshes of central and south Florida (Jordan et al. 1996a, 1996b; Milleson 1976; J.W. Koebel Jr., personal observation). Mean crayfish density within a broadleaf marsh habitat of the channelized Kissimmee River approached 40/m^2 when the marsh was inundated to a depth > 20 cm (J.W. Koebel Jr., personal observation). Moderate mean annual density and associated biomass of crayfish and other large invertebrates is expected in restored broadleaf marsh habitats, and likely will contribute to a high rate of annual invertebrate community production. Although species-specific estimates of annual production are highly variable, annual macroinvertebrate production likely will be > 75 $g/m^2/yr$. This represents a greater than 13-fold increase over floodplain macroinvertebrate production estimates within broadleaf marsh habitats of the channelized Kissimmee River ecosystem.

Mechanism Relating Restoration to Reference Condition: Restoration of historic hydroperiods will be the impetus for aquatic invertebrate colonization and increased production within existing broadleaf marshes. Colonization of restored broadleaf marsh by macroinvertebrates likely will occur through direct immigration of aerial adults, oviposition by adults, and movement (passive and active) of adults and larvae from the river channel during periods of rising stage.

Time Course for Restoration: Restoration of floodplain invertebrate community structure and production likely will be rapid. Aerial colonization of existing and newly established broadleaf marsh by mobile adults of most orders likely will occur within three months of restored hydrology. Less mobile invertebrates (amphipods, crustaceans, isopods, and gastropods) should colonize within one year of inundation, provided that a representative complement of vegetation and associated periphyton community has become established. It is possible that time frames for restoration may need adjustments if re-establishment of appropriate hydrology is delayed.

Adjustments for External Constraints: None: It is unlikely that any macroinvertebrate taxa were extirpated following channelization. Because all taxa likely to colonize restored broadleaf marsh habitats occur within the Kissimmee-Okeechobee ecosystem, there are no external constraints which would delay, preclude, or inhibit restoration of productivity of this community. However, because river stage and discharge (and therefore, overbank flow and floodplain inundation characteristics) will be driven by rainfall in the restored system, drought or less than normal seasonal rainfall may influence inundation patterns and rates of invertebrate production.

Means of Evaluation: Sampling of existing broadleaf marsh habitats will commence approximately one year following initiation of the interim upper basin regulation schedule assuming that this time period has been sufficient to re-establish floodplain hydroperiods and aquatic invertebrate community structure characteristics of historic broadleaf marshes. Methods will be identical to those outlined in Anderson et al. (1998), and include the collection of replicate (5, minimally) "stovepipe" samples from randomly selected locations within broadleaf marsh habitats in Pools A and C. Samples will be collected quarterly (at a minimum), and analyzed for invertebrate species identity, species richness, functional feeding group composition, mean annual density, and mean standing stock biomass. Production will be calculated using the instantaneous growth rate method (IGR) and compared to the stated expectation.

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